

with one another. Thus, the controller 16 judges whether or not the maximum reception level throughout the base stations BS2 exceeds a predetermined level. If the maximum reception level is higher than the predetermined level, the controller 16 sends a control signal to the base station BS2 having the maximum reception level so that the cellular communication is continued via the base station ("hand-off"). If not so, the controller 16 judges that any communication with a signal quality better than the predetermined level cannot be carried out even by the use of the cellular system and informs the controller 9 of the reception level through the connectors 29 and 28. The controller 9 monitors the operations of the components of the transceiver 5C even in the cellular mode to detect the reception level or error rate. The controller 9 compares the reception level provided by the controller 16 with the reception level or error rate detected by the controller 9 itself. If the controller 9 judges that a better communication can be carried out by utilizing the satellite mode than by utilizing the cellular mode, it is reported to the controller 16 through the connectors 26 and 27. Thus, the controller 16 actuates the switches 26 and 27 to select the satellite mode. This realizes the alternating from the cellular system to the satellite communication system. If it is not judged that good communication can be carried out in the satellite mode, the cellular mode will be continued.

In such a manner, the seventh embodiment can automatically select and perform the hand-off in the cellular communication or the alternating between the satellite communication and the cellular communication. The usability of the terminal equipment can be improved.

#### (8) Eighth Embodiment

FIGS. 22-24 show the eighth embodiment of the present invention in which a hand set 24E is used in place of the hand set 24D of the seventh embodiment. The hand set 24E utilizes a base band circuit 7A and voice codec 8A in place of the modulator/demodulator 15. The controller 16 performs the hand-off in the cellular system and the alternating between a plurality of cellular systems by detecting and comparing the signal reception level or the error rate (number of error bits per unit amount of information). The controller 9 performs the alternating between the cellular system and the satellite communication by detecting the error rate in the transceiver 5C and comparing it with the signal reception level or the error rate in the cellular reception circuit. Therefore, the eighth embodiment can be applied to the digital cellular communication system. The other components and advantages are similar to those of the seventh embodiment.

We claim:

1. A mobile communication terminal equipment mountable in a vehicle comprising:
  - a satellite transceiver mountable in said vehicle and including a satellite transmission/reception circuit for transmitting and receiving signals through a satellite wireless communication system; and
  - a portable set disconnectable from the satellite transceiver so that the set can be carried by a user, said portable set comprising:
    - a terrestrial transmission/reception circuit for transmitting and receiving signals through a terrestrial wireless communication system;
    - a signal input/output circuit for inputting signals from the user and for outputting signals to the user; and
    - a connection controller and switching means for selectively connecting the signal input/output circuit to one of the satellite transceiver and terrestrial transmission/

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5. A mobile communication terminal equipment as defined in claim 4 wherein said terrestrial transmission/reception circuit comprises:

transmission means for transmitting the signal from the signal input/output circuit by coding the signal, by digitally modulating a transmission signal using the coded signal as a modulation signal and by supplying the transmission signal to the portable terrestrial communication antenna; and

reception means for digitally demodulating and decoding the signal received by the portable terrestrial communication antenna,

wherein when the terrestrial transmission/reception circuit is in connection with the signal input/output circuit, said terrestrial control means causes the signal from the signal input/output circuit to be sent to the transmission means and also causes the reception means to send the decoded signal to the signal input/output circuit as the signal to be outputted.

6. A mobile communication terminal equipment as defined in claim 4 wherein said terrestrial transmission/reception circuit comprises:

transmission means for transmitting the signal from the signal input/output circuit by analog modulating a transmission signal using the signal from the signal input/output circuit as a modulation signal and by supplying the transmission signal to the portable terrestrial communication antenna; and

reception means for analog demodulating the signal received by the portable terrestrial communication antenna,

wherein when the terrestrial transmission/reception circuit is in connection with the signal input/output circuit, said terrestrial control means causes the signal from the signal input/output circuit to be sent to the transmission means and also cause the reception means to send the demodulated signal to the signal input/output circuit as the signal to be outputted.

7. A mobile communication terminal equipment as defined in claim 1;

wherein the satellite transceiver further includes a stationary terrestrial communication antenna fixedly mounted in the vehicle to perform a wireless signal transmission/reception between the mobile communication terminal equipment and a base station of the terrestrial wireless communication system; and

wherein said portable set further includes:

a portable terrestrial communication antenna fixedly mounted in the portable machine to perform a wireless signal transmission/reception between the mobile communication terminal equipment and the base station of the terrestrial wireless communication system;

an antenna connection switching means for selectively connecting one of the stationary and portable terrestrial communication antennas to the terrestrial transmission/reception circuit, the terrestrial transmission/reception circuit supplying a signal to be transmitted to the selected one of the stationary and portable terrestrial communication antennas and receiving a signal from the selected one of the stationary and portable terrestrial communication antennas; and

terrestrial control means responsive to the connection of said terrestrial transmission/reception circuit with the signal input/output circuit and stationary terrestrial communication antenna for causing a signal from the

signal input/output circuit to be transmitted from the stationary terrestrial communication antenna to the base station through the terrestrial transmission/reception circuit and for causing a signal received by the stationary terrestrial communication antenna to be supplied to the signal input/output circuit through the terrestrial transmission/reception circuit as a signal to be outputted, said terrestrial control means responsive to the connection of the terrestrial transmission/reception circuit with the signal input/output circuit and portable terrestrial communication antenna for causing the signal from the signal input/output circuit to be transmitted from the portable terrestrial communication antenna to the base station through the terrestrial transmission/reception circuit and for causing a signal received by the portable terrestrial communication antenna to be sent to the signal input/output circuit through the terrestrial transmission/reception circuit as the signal to be outputted.

8. A mobile communication terminal equipment as defined in claim 7, wherein said antenna connection switching means includes an antenna selection switch responsive to a command from the terrestrial control means for selectively connecting one of said stationary and portable terrestrial communication antennas with the terrestrial transmission/reception circuit.

9. A mobile communication terminal equipment as defined in claim 7 wherein said terrestrial transmission/reception circuit comprises:

transmission means for transmitting the signal from the signal input/output circuit by coding the supplied signal, by digitally modulating a transmission signal using the coded signal as a modulation signal and by supplying the transmission signal to the selected one of the stationary and portable terrestrial communication antennas; and

reception means for digitally demodulating and decoding the signal received by the selected one of the stationary and portable terrestrial communication antennas,

wherein when the terrestrial transmission/reception circuit is in connection with the signal input/output circuit, said terrestrial control means causes the signal from the signal input/output circuit to be sent to the transmission means and also causes the reception means to send the decoded signal to the signal input/output circuit as the signal to be outputted.

10. A mobile communication terminal equipment as defined in claim 7 wherein said terrestrial transmission/reception circuit comprises:

transmission means for transmitting the signal from the signal input/output circuit by analog modulating a transmission signal using the signal from the signal input/output circuit as a modulation signal and by supplying the transmission signal to the selected one of the stationary and portable terrestrial communication antennas; and

reception means for demodulating the signal received by the selected one of the stationary and portable terrestrial communication antennas into an analog signal,

wherein when the terrestrial transmission/reception circuit is in connection with the signal input/output circuit, said terrestrial control means causes the signal from the signal input/output circuit to be sent to the transmission means and also causes the reception means to send the demodulated signal to the signal input/output circuit as the signal to be outputted.

a satellite communication antenna fixedly mounted on the vehicle to perform a wireless signal transmission/reception between the mobile communication terminal equipment and an artificial satellite; the satellite transmission/reception circuit supplying the signal to be transmitted to the satellite communication antenna and receiving a signal from the satellite communication antenna; and

satellite control means responsive to the connection of the satellite transmission/reception circuit with the signal input/output circuit for causing the signal from the signal input/output circuit to be transmitted from the satellite communication antenna to the artificial satellite through the satellite transmission/reception circuit and for causing a signal received by the satellite communication antenna from the artificial satellite to be sent to the signal input/output circuit through the satellite transmission/reception circuit as the signal to be outputted, said satellite control means providing a signal indicative of the connection between the satellite transceiver and the portable set to the satellite control means.

wherein said terrestrial control means responsive to the absence of the signal from the satellite control means indicative of the connection between the satellite transceiver and the portable machine for controlling the antenna connection switching means to connect the portable terrestrial communication antenna with the signal input/output circuit, said terrestrial control means further responsive to both the connections between the signal input/output circuit and the terrestrial transmission/reception circuit and between the satellite transceiver and the portable set for controlling the antenna connection switching means to connect the stationary terrestrial communication antenna with the signal input/output circuit.

12. A mobile communication terminal equipment as defined in claim 1:

wherein the satellite transceiver includes a satellite control means for monitoring the signal reception state at the satellite transmission/reception circuit;

wherein the portable set further includes a terrestrial control means for monitoring the signal reception state at the terrestrial transmission/reception circuit and for reporting, to the satellite control means, when the portable set is in connection with the satellite transmitter; and

wherein said satellite control means judges the signal reception state of the satellite transmission/reception circuit and the signal reception state of the terrestrial transmission/reception circuit reported from the terrestrial control means by comparing with a predetermined reference condition, the satellite control means controls the connection switching means solely or in cooperation with the terrestrial control means to connect the terrestrial transmission/reception circuit with the signal input/output circuit when said satellite control means judges that the signal reception state of the terrestrial transmission/reception circuit is sufficient to continue a signal reception at the terrestrial transmission/reception circuit, said satellite control means further controls the connection switching means solely or in cooperation with the terrestrial control means to connect the satel-

lite transmission/reception circuit with the signal input/output circuit when the signal reception state of the terrestrial transmission/reception circuit is not sufficient to continue the signal reception at the terrestrial transmission/reception circuit and a relatively good communication can be attained by executing a signal reception at the satellite transmission/reception circuit.

13. A mobile communication terminal equipment as defined in claim 12 wherein said predetermined reference conditions are reference reception levels set for respective ones of the signal reception states at the satellite and terrestrial transmission/reception circuits or reference error rates set for respective ones of the signal reception states at the satellite and terrestrial transmission/reception circuits.

14. A mobile communication terminal equipment as defined in claim 1 wherein said signal input/output circuit includes a microphone for receiving voice signals from the user with voice and a loudspeaker for outputting signals from the user as sound.

15. A mobile communication terminal equipment as defined in claim 1;

wherein said satellite transceiver includes satellite control means for controlling the signal transmission/reception at the satellite transmission/reception circuit,

wherein said terrestrial transmission/reception circuit includes terrestrial control means for controlling the signal transmission/reception at the terrestrial transmission/reception circuit,

wherein said signal input/output circuit further includes command input means for inputting a user's command relating the operation of at least one of said satellite transmission/reception circuit, said terrestrial transmission/reception circuit and said connection switching means, and display control means for displaying at least one of the operational state of said terrestrial transmission/reception circuit, the signal transmission/reception state of said satellite transmission/reception circuit, the operational state of said terrestrial transmission/reception circuit, the signal transmission/reception state of said terrestrial the signal transmission/reception circuit, the operational state of said connection switching means and the signal input/output state of said signal input/output circuit;

wherein said signal input/output circuit is controlled by the satellite control means when the satellite transmission/reception circuit is connected to the signal input/output circuit and by the terrestrial control means when the terrestrial transmission/reception circuit is connected to the signal input/output circuit; and

wherein control signals are transmitted and received between the satellite control means, the terrestrial control means and the signal input/output circuit, said control signals including information which is indicative at least one of the signal reception state of the satellite transmission/reception circuit, the signal

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reception state of the terrestrial transmission/reception circuit, the operational state of the connection switching means and a command from the command input means.

16. A mobile communication terminal equipment as defined in claim 15 wherein said command input means inputs the command from operating key means operable by the user.

17. A mobile communication terminal equipment as defined in claim 15;

wherein said connection switching means includes a first switch for selectively supplying a signal from the signal input/output circuit to one of said satellite and terrestrial transmission/reception circuits and for selectively supplying a signal from one of said satellite and terrestrial transmission/reception circuits to the signal input/output circuit as a signal to be outputted and a second switch for switching a control signal path between a first channel for connecting the satellite control means to the signal input/output circuit and a second channel for connecting the terrestrial control means to the signal input/output circuit; wherein the user's commands through the command input means includes a switching command indicative of which one of said satellite and terrestrial transmission/reception circuits should be connected with the signal input/output circuit, the terrestrial control means for controlling the first and second switches to connect the satellite transmission/reception circuit with the signal input/output circuit when the switching command indicates that the satellite transmission/reception circuit should be connected to the signal input/output circuit and also for controlling the first and second switches to connect the terrestrial transmission/reception circuit with the signal input/output circuit when the switching command indicates that the terrestrial transmission/reception circuit should be connected to the signal input/output circuit.

18. A mobile communication terminal equipment as defined in claim 17;

wherein the satellite transceiver and portable set include connectors electrically connectable/disconnectable with each other; and

wherein when the connector in the satellite transceiver is electrically connected to the connector in the portable set, the mobile communication terminal equipment selectively executes one of the communications through the satellite and terrestrial wireless communication systems, and when the connector in the satellite transceiver is electrically disconnected from the connector in the portable machine, the mobile communication terminal equipment executes the communication through the terrestrial wireless communication system.

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19. A mobile communication terminal comprising:  
a satellite transceiver including a satellite  
transmission/reception circuit for transmitting and receiving  
signals through a satellite wireless communication system; and  
a portable set disconnectable from the satellite transceiver  
and including  
a terrestrial transmission/reception circuit for  
transmitting and receiving signals through a terrestrial wireless  
communication system,  
a signal input/output circuit for inputting signals from the  
user and for outputting signals to the user, and  
a connection controller and switching means for selectively  
connecting the signal input/output circuit to one of the  
satellite transceiver and terrestrial transmission/reception  
circuits when said portable set is connected to said satellite  
transceiver and for connecting said signal input/output circuit  
to said terrestrial transmission/reception circuit when said  
portable set is disconnected from said satellite transceiver.

20. A mobile communication terminal equipment as defined in claim 19,

wherein said portable set further includes terrestrial control means for controlling the signal transmission/reception at the terrestrial transmission/reception circuit, and

21. A mobile communication terminal equipment as defined in claim 20.

wherein control signals are transmitted and received between the satellite control means, the terrestrial control means and the command input means, said control signals including information which is indicative at least one of the signal reception state of the satellite transmission/reception circuit, the signal reception state of the terrestrial transmission/reception circuit, the operational state of the switching means, and a command from the command input means.

wherein the terrestrial control means controls the switching means in response to an instruction by the satellite control means when the satellite transmission/reception circuit is connected to the signal input/output circuit, and controls the

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